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VAD01 APU System Performance Requirements to EPS Module

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Revision history

Previous Version	Current Version	Version Description	Responsible	Date
N/A	Draft V1.0	Specify APU performance requirement parameters to EPS for VAD01	整车开发	2018-02-22

Change log

Release	Section	Change Description

Contents

1 Introduction

1.1 Scope of Document

This document specifies VAD01 APU system performance requirements to EPS module for Qoros CF16.

1.2 Reference document

Table 1.2.1 lists the reference documents.

Table 1.2.1: Reference

Reference Num	Source		Title	Version or date	Document Number

1.3 Abbreviation

.Table 1.3.1 lists the reference words.

Table 1.3.1: Abbreviation

Acronyms	Description
APU	Auto-Pilot Unit

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2 The Steering Angle Resolution and Update Rate

Semi-automatical APU system function is realized by controlling steering wheel angle. Its resolution directly affects the vehicle angle positional resolution. The steering angle resolution is lower,the deviation of vehicle final park position is greater.

The steering angle resolution must be controlled **within 0.1deg**. And in order to make sure trajectory accuracy, update rate of steering angle also should be quick engough. Its value required is **10 ms**.

Example:

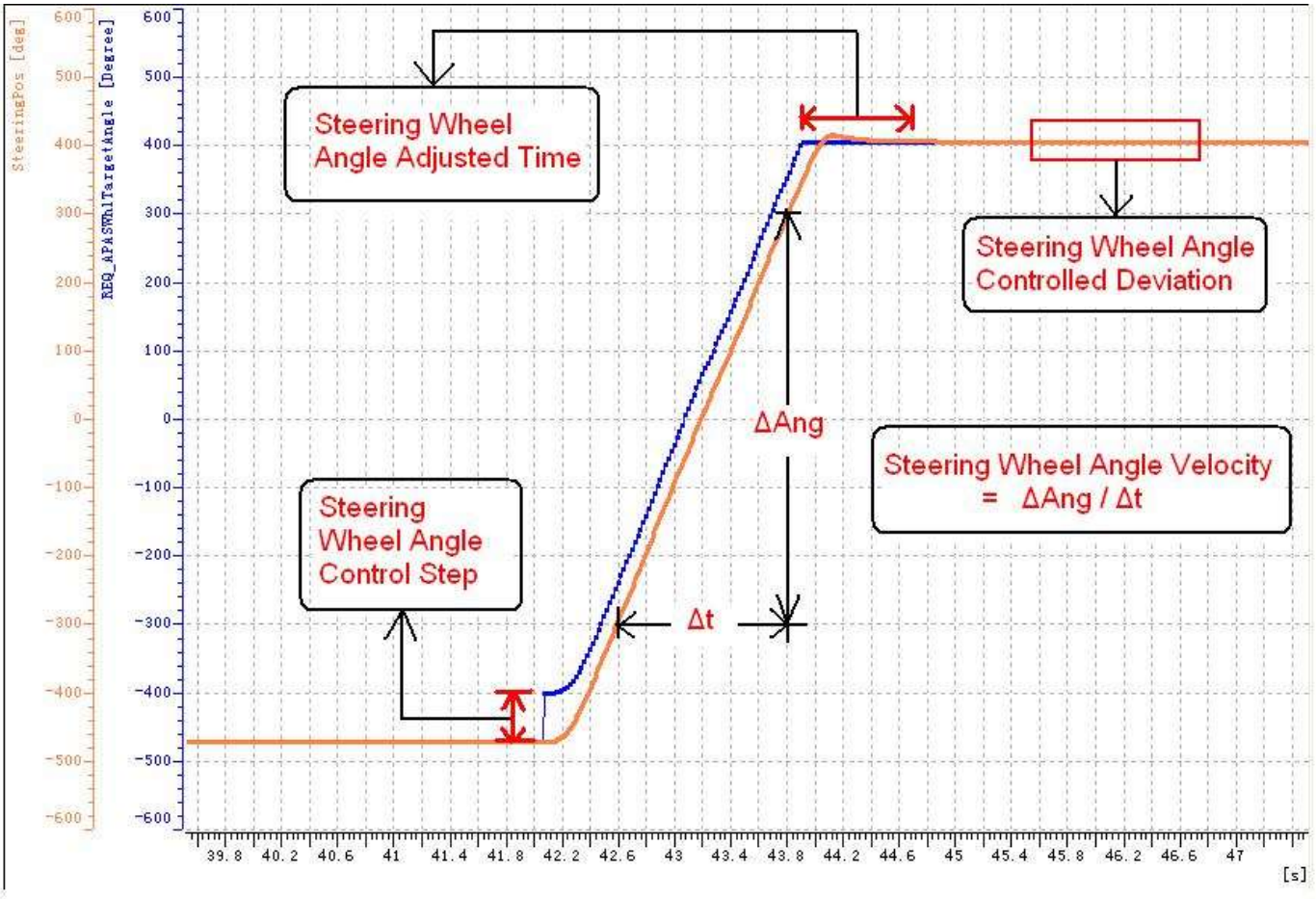
Message	Signal Name	Length (Bit)	Byte Order	Unit	Factor	Offset	Value Range
APU_PDC_1 (0x131)	REQ_APUSWhlTargetAngle	16	Intel	deg	0.1	- 800	Min:- 800.0 Max: 800.0
EPS_2 (0x0F8)	EPS_ActStrAngle	15	Intel	deg	0.04375	0	Min: 0 Max: 1433.51
SCM_4 (0x0F5)	SteeringPos	16	Intel	deg	0.1	- 800	Min:- 800.0 Max: 800.0

3 Steering Wheel Controlling Interaction between APU and EPS

3.1 Steering Wheel Controlling Strategy

After getting the right to control EPS (STAT_EPSCtrlAvailable = Active), APU module would adopt a kind of steering wheel angle guiding method to make steering wheel angle change from current angle to target angle.

For instance, please see the following graphics, **Blue line** indicates target angle (signal: REQ_APUSWhl TargetAngle) and **Orange line** indicates current steering angle (signal: SteeringPos). As graphics showed, current angle is - 470°and final target angle is 400. In order to achieve target angle, first of all, APU target angle would change by step of “Steering Wheel Angle Control Step” , so APU_Angle_Target equals - 400°(SteeringPos + Steering Wheel Angle Control Step = - 470°+ 70°= - 400°). And then EPS completes individual processing and steering wheel starts to turn. As current angle increasing, target angle would increase at the same time and keep a constant difference value until reach final target angle (400°).



3.1.1 Steering Wheel Angle Control Step

Steering wheel angle control step is used to keep the difference value between cureent angle and target angle to guide steering wheel to turn. And the requirement is that when detecting the difference value between cureent angle and target angle is great than V, the steering actuator(EPS) shoud be able to turn in its physical angle velocity (maximum steering wheel angle velocity). If steering actuator can turn in its physical angle velocity under V, it is also OK for APU system.

What's more, the value of V should be **less than 90 deg** and in order to make target angle curve more smooth, we hope its value can be **less than or equal to 50 deg**.

3.1.2 Dead Time / EPS individual processing time

The computing time inside the EPS shall **not take longer than 70 ms** (i.e. it shall not take longer than 70 ms from receiving the desired road wheel angle from the APU module until full power is applied on the actuators).

3.1.3 Steering Wheel Angle Acceleration

Steering wheel angle acceleration is the decisive factor for the time changing steering wheel angle velocity from 0 to physical angle velocity (maximum steering wheel angle velocity). And this value should be **great than or equal to 1200 deg / s^2**.

3.1.4 Steering Wheel Angle Velocity

For steering wheel angle velocity or angle acceleration, if they are not big enough or EPS's dead time is rather big, then in the process of automatic parking , EPS can't quickly control steering wheel turn to the desired angle, which will make parking trajectory deviate from desired trajectory. As a consequence, automatical parking performance is not ideal.

Therefore, whether the vehicle is moving or standstill, physical steering wheel angle velocity should be **great than or equal to 450 deg / s** and it would be better if its value can be close to 500 deg / s. For the sake of function safty, we suggest the maximum steering wheel angle velocity shall **not exceed 500 deg / s**.

3.1.5 Steering Wheel Angle Adjusted Time

This time is measured from target angle stability to current angle stability. EPS is permitted to adjust steering wheel angle to meet steering wheel angle controlled deviation, but it should be completed within maximum steering wheel angle adjusted time, which is **1 s**.

What's more, the fluctuation angle should be controlled **within 20 deg** (|current angle – stable target angle | <= 20 deg).

3.1.6 Steering Wheel Angle Controlled Deviation

This is the absolute difference value between current angle and target angle when target angle is stable (Steering Wheel Angle Controlled Deviation = | SteeringPos - REQ_APUSWhl Target Angle |). It should be **less than or equal to 1°**.

3.1.7 Steering Wheel Controlled Angle Range

In normal situation, the maximum target angle sent by APU would be 90% ~ 95% of maximum physical steering wheel. But if vehicle's minimum turning radius can not meet requirement, this percentage may be great than 95%. Therefore, the maximum steering wheel controlled angle should be **great than or equal to 95%** of maximum physical steering wheel.

3.1.8 Jump signal (Optional)

When APU request EPS to turn to the target angle, the angle requested by APU gradually increases by a certain step every time. The steering wheel angle requested by APU via CAN will increase a corresponding step in each sending cycle, meanwhile make sure that the angle difference between this cycle request and last cycle must not over AngMAX and the angle difference between this cycle request and the current angle returned from EPS must not over AngMAX. When APU request angle changes frequently, EPS shall exit from Active state and enter Permanently Failed state, and will not recover until power is off and on again.

At present, VAD01 defined the jump signal to be **90deg**, when EPS receives **3 continous** jump signal which is **over 90deg**, EPS should exit from Active state.

3.2 Maximum Torque Applied to Driver

The EPS must indicate when the driver tries to control the steering wheel. An intervention of the driver at the steering wheel during active steering control shall be recognized by the steering actuator. If the driver interferes with the steering wheel during control, the torque applied to driver is **above 3 Nm** for **50 ms**, the EPS shall send bus message back to the APU module to cancel the parking maneuver.